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(54) **Fuel pump**

(57) A boost assembly (100) for a rotary fuel pump (10) of an internal combustion engine including a turbocharger, the boost assembly (100) comprising a housing (102), a control member (138) which is cooperable with an adjuster of the fuel pump (10) so as to adjust the fuel pump output, a displacement element (110) cooperable with the control member (138), a valve plate (120) engageable with a valve seat (140) so as to define a first position of the control member (138), and limiting means (165,170) arranged to define a second position of the control member (138). The valve plate (120) is movable away from the valve seat (140) in response to air pressure from the turbocharger so as to control whether the diaphragm (110) is exposed to air flow from the turbocharger, thereby to cause the control member (138) to move from the first position to the second position, and the boost assembly (100) includes an adjustment means for adjusting the axial position of the valve seat (140) relative to the housing (102), thereby to adjust the first position of the control member (138).

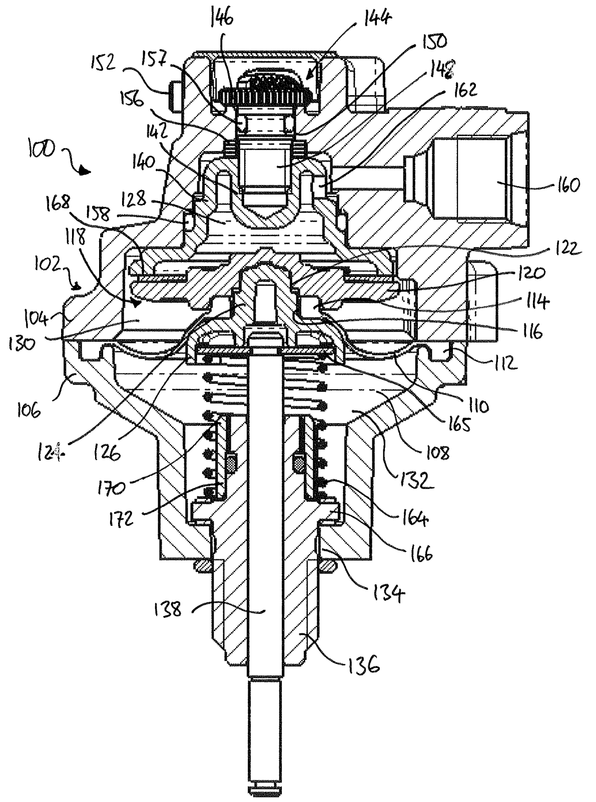

FIGURE 2

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Description

Field of the invention

[0001] The present invention relates to fuel pumps. In particular, the present invention relates to apparatus for controlling the output of a rotary fuel injection pump used to supply fuel to fuel injectors in an internal combustion engine.

Background to the invention

[0002] A conventional rotary fuel injection pump is shown schematically in Figure 1 of the accompanying drawings. The pump 10 comprises a rotor 12 including a bore 14, and one or more plungers 16 reciprocable within the bore 14. The rotor 12 is rotatable within an annular cam arrangement, sometimes known as a cam ring 18, which surrounds the rotor 12.

[0003] The cam ring 18 has a profile (indicated in part by the dashed line in Figure 1) which includes a number of angularly-spaced projections or lobes 20, arranged in oppositely-facing pairs such that the cam ring 18 has a minimum internal diameter between a pair of lobes, and a maximum diameter at an angular position intermediate between two adjacent lobes.

[0004] One or more angularly adjustable annular plates, known as scroll plates 22, are provided adjacent to the cam ring 18. Each scroll plate 22 comprises a number of arcuate sections 24 on its internal diameter, which are arranged so that the diameter of the scroll plate 22 decreases from one end of an arcuate section 22 to the other.

[0005] The number of lobes 20 provided on the cam ring 18 and the number of arcuate sections 22 provided on the scroll plates 22 correspond to the number of cylinders of the engine.

[0006] Each plunger 16 is associated with a cam roller 26 which is arranged to roll along the inner surfaces of the cam ring 18 or the scroll plates 22, according to whether the cam ring 18 or the scroll plates 22 present the minimum diameter at a given angular position of the rollers 26.

[0007] The cam ring 18 imparts an inward radial movement on the plungers 16 as the rotor 12 rotates and the cam rollers 26 ride onto the lobes 20 of the cam ring 18. When a roller 26 passes over a lobe 20, the roller 26, and its associated plunger 16, can move outwards again. In this way, the plungers 16 reciprocate within the bore 14 as the rotor 12 rotates. The scroll plates 22 serve to limit the maximum outward travel of the rollers 26, and hence the plungers 16, during rotation of the rotor 12.

[0008] The rotor 12 further comprises a distributor (not shown in Figure 1) which rotates within a distributor head. The distributor comprises passages arranged to connect the bore 14 with inlet and outlet passages for fuel provided within the distributor head. Typically, one inlet passage is provided and the number of outlet passages provided corresponds to the number of cylinders in the engine. The inlet passage receives a supply of fuel at a moderately high pressure from a fuel transfer pump (not shown in Figure 1). Each outlet passage is connected to a corresponding fuel injector associated with a single one of the cylinders of the engine.

[0009] In use, the rotor 12 is driven in a rotating motion by an auxiliary drive belt connected to the engine, or by other means. The distributor head is arranged so that, as the rotor 12 rotates, the bore 14 is connected alternately to the inlet passage and to each of the outlet passages in turn. At intermediate positions, when the bore 14 is not connected to the inlet or outlet passages, the bore 14 is closed.

[0010] When the bore 14 is connected to the inlet passage, the bore 14 fills with fuel at moderately high pressure, which acts to push the plungers 16 outwards. Then, as the rotor 12 turns, the distributor head moves to an intermediate position to close the bore 14 and the rollers 26 abut a pair of lobes 20 of the cam ring 18 so that the plungers 16 move inwards as described above. The fuel pressure in the bore 14 therefore increases significantly.

[0011] The distributor head then moves to connect the bore 14 to an outlet passage, whereupon fuel at high pressure is released from the bore 14 for delivery to the fuel injector via the outlet passage. On continued rotation of the distributor head, the bore 14 is first closed and then becomes connected to the inlet passage once again. Simultaneously, each roller 26 moves off a lobe 20 of the cam ring 18, allowing the plungers 16 to move outwards again. In this way, fuel is delivered at high pressure to each of the fuel injectors of the engine in turn.

[0012] The quantity of fuel required for delivery by the pump varies according to engine speed and demand. If excess or insufficient fuel is delivered by the pump under a given engine operating condition, the engine may run inefficiently, harmful exhaust gas emissions and smoke output may increase, and the smooth running and driveability of the engine may be impaired.

[0013] For these reasons, it is necessary to provide means by which the maximum amount of fuel introduced to the bore in one pumping cycle can be adjusted. The angular position of the scroll plates 22 can be adjusted relative to the cam ring 18 so as to change the extent of travel of the plungers 16 that occurs while the bore 14 is in communication with the inlet passage of the distributor head. The amount of fuel drawn into the bore 14 is therefore controllable.

[0014] Angular movement of the scroll plates 22 is conventionally effected by linear movement of a scroll plate carriage 28 which engages with the scroll plates 22. Linear movement of the scroll plate carriage 28 is achieved by an actuator arrangement comprising a cam follower 30 driven by a cam 32. In the pump of Figure 1, the cam follower 30 comprises a lever pivotally mounted to a control pin 34, to be described in more detail below. One end of the cam follower 30 abuts the cam 32, while the other end acts upon a projection of the scroll plate carriage 28.

[0015] The cam 32 comprises an elongate, generally cylindrical body mounted for axial movement within the pump 10. The cam 32 moves axially, relative to the cam follower 30, in response to variations in the pressure of fuel supplied from the transfer pump, which in turn depends on the engine speed. The diameter of the cam 32 varies along its length, so that the cam follower 30 turns about its pivot as the cam 32 moves axially. The scroll plate carriage 28, and hence the scroll plates 22, are therefore moved in response to variations in the fuel pressure supply to allow control of the quantity of fuel output by the pump 10. Typically, at engine start-up, a relatively large quantity of fuel is delivered. As the engine speed increases, the relative quantity of fuel delivered is reduced.

[0016] In turbocharged engines, a further requirement for control of the fuel output arises. When the turbocharger is operating, the fuel output must increase to match the increased air charge, or 'boost', which is forced into the cylinders by the turbocharger.

[0017] Conventionally, a boost controller or boost assembly 36 is fitted to the fuel pump 10 to provide this additional control. The boost assembly 36 comprises a pin 34 attached at one end to a moveable diaphragm 38 and a valve plate 40. A second end of the pin 34 supports the pivot of the cam follower 30 at a pin joint. In this way, the pin 34 arranged to effect linear movement of the scroll plate carriage 28 by displacement of the cam follower 30. In this case, the cam follower 30 pivots about the point where the cam follower 30 abuts the cam 32.

[0018] The valve plate 40 is biased into engagement with a seating surface 42 of the body of the boost assembly 36 by a biasing spring 44. The valve plate 40 is exposed on one side to air 46 at a pressure that relates to the output pressure of the turbocharger. When the output pressure of the turbocharger increases above a threshold value, the valve plate 40 unseats from the seating surface 42 so that the valve plate 40 is displaced. As a result, the diaphragm 38 is deformed by the air 46 acting on it at high pressure, causing axial movement of the pin 34. This movement of the pin 34, in turn, causes linear movement of the scroll plate carriage 28 and angular displacement of the scroll plates 22.

[0019] The movement of the pin 34, and hence the displacement of the scroll plates 22, is therefore non-linear with respect to the output pressure of the turbocharger. When the output pressure of the turbocharger increases above the threshold value, corresponding to the onset of turbocharger boost, the diaphragm 38, and hence the pin 34, undergo a relatively large displacement that results in a significant angular rotation of the scroll plates 22 in a direction to cause an increase in the maximum plunger displacement. In this way, the quantity of fuel delivered by the injection pump 10 is increased by the required amount when the turbocharger boost begins.

[0020] While such an arrangement has historically provided generally adequate adjustment of the fuel delivery to compensate for turbocharger boost, increasingly stringent emissions requirements mean that it would be desirable to synchronise more accurately the delivery of an increased fuel output by the pump with the build-up of turbocharger boost. If the increased fuel output does not correctly correspond to the increase in turbocharger boost pressure, excessive smoke and increased emissions can occur and the fuel economy of the engine will be impaired, and these outcomes are increasingly undesirable.

[0021] In the known boost assembly described above, for example, the air pressure at which the diaphragm undergoes a large displacement may be different to the desired value as a result of variations in component dimensions due to manufacturing tolerances, or as a result of wear of components during use of the device. It can therefore be difficult to obtain the desired characteristics of the injection pump during turbocharger boost both during assembly and commissioning of the engine and during service of the engine.

[0022] Against this background, it would be desirable to provide a boost assembly for a fuel injection pump which mitigates or eliminates the problems associated with the prior art.

Summary of the invention

[0023] According to the present invention, there is provided a boost assembly for a rotary fuel pump of an internal combustion engine including a turbocharger, the boost assembly comprising a housing, a control member which is cooperable with an adjuster of the fuel pump so as to adjust the fuel pump output, a displacement element cooperable with the control member, a valve plate engageable with a valve seat so as to define a first position of the control member, and limiting means arranged to define a second position of the control member, wherein the valve plate is movable away from the valve seat in response to air pressure from the turbocharger so as to control whether the diaphragm is exposed to air flow from the turbocharger, thereby to cause the control member to move from the first position to the second position. The invention is characterised in that the boost assembly includes an adjustment means for adjusting the axial position of the valve seat relative to the housing, thereby to adjust the first position of the control member.

[0024] In this way, the present invention provides a boost assembly in which the stroke of the control member can be adjusted. The effect of dimensional variations in the components of the boost assembly and the pump due to manufacturing tolerances or wear in use can thereby be reduced or eliminated. Furthermore, the boost assembly can be 'tuned' to operate most effectively in a given engine, both during manufacture and commissioning of the engine and over the operating life of the engine.

[0025] Preferably, the limiting means comprises a stop. In addition, the limiting means may comprise a stop element associated with the valve plate, wherein the stop element abuts the stop in use of the assembly so as to define the second position of the control member.

[0026] The assembly may comprise a biasing spring which serves to urge the valve plate against the valve seat. In this case, the stop element may be a spring plate associated with the valve plate, arranged so that one end of the biasing spring acts against the spring plate. The spring plate may be housed or otherwise engaged with a flange of the valve plate. When provided, the valve plate, the flange and the spring plate together define, in whole or in part, a stop member of the assembly.

[0027] The displacement element is preferably a diaphragm having a central portion associated with the control member and a peripheral portion attached to the housing. Alternatively, the displacement element may be a piston or similar device.

[0028] In one embodiment, the housing defines, in part, a first chamber within which the valve seat is housed. The boost assembly may further comprise a second chamber defined in part by the valve member and in part by the displacement element. In this case, in use of the assembly, the first chamber receives air from an output of the turbocharger, and an increase in air pressure within the first chamber causes unseating of the valve member to allow air flow between the first chamber and the second chamber, thereby causing displacement of the displacement element and axial movement of the control member.

[0029] Preferably, the boost assembly further comprises a sealing element to prevent air flow from the first chamber to the second chamber between the valve seat and the housing.

[0030] The adjustment means may comprise a shaft which is threadedly engaged with a recess in the valve seat. The adjustment means may, alternatively or in addition, comprise a gear head, wherein the boost assembly further comprises a gear mechanism for turning the adjustment means by way of the gear head. The gear mechanism may, for example, comprise a worm screw mounted in engagement with the gear head.

[0031] The valve seat may comprise a bell-shaped element. Preferably, the valve seat comprises a seating surface arranged to sealingly engage with the valve member. The valve seat may comprise a passage for communication of air from an output of the turbocharger through the valve seat.

[0032] The valve member may comprise a generally circular plate-like element. Preferably, the valve member is cooperable with the control member. The valve member and/or the valve seat may carry a further sealing element, such as a rubber annulus, for ensuring an airtight seal between the valve member and the valve seat.

[0033] The invention also extends to a fuel pump for supplying pressurised fuel to an internal combustion engine, comprising a boost assembly according to the invention, and an adjuster cooperable with the control member (138) of the fuel pump, wherein displacement of the control member (138) from the first position to the second position causes an increase in fuel output of the pump.

Brief description of the drawings

[0034]

Figure 1 of the accompanying drawings, which shows a known rotary injection pump, has already been referred to above. Preferred embodiments of the present invention will now be described, by way of example only, with reference to the remaining drawings, in which:

Figure 2 is a cross-sectional side view of a boost assembly according to the present invention; and

Figure 3 is a cross-sectional plan view of the boost assembly of Figure 2.

[0035] Throughout the specification, relative terms such as 'upper', 'lower', 'top' and 'bottom' are used with reference to the orientation of the boost assembly as shown in the drawings. However, it will be appreciated that the boost assembly could have any orientation and these terms should be construed accordingly.

Detailed description of preferred embodiments of the invention

[0036] Referring to Figure 2, according to a preferred embodiment of the present invention there is provided a boost assembly 100 including a housing 102 comprising a boost assembly cover 104 and a casing 106. The cover 104 and the casing 106 are shaped so as to enclose an internal volume 108 within the housing 102 of the boost assembly 100.

[0037] The internal volume 108 of the boost assembly 100 is divided approximately horizontally by a displacement element comprising an annular diaphragm 110. The outer, peripheral edge 112 of the diaphragm 110 is clamped between the cover 104 and the casing 106, so as to form an annular seal between the cover 104 and the casing 106.

[0038] The inner edge 114 of the diaphragm 110, forming the periphery of a central opening 116 in the diaphragm 110, is clamped between an upper and lower portions of a stop member 118. The upper portion of the stop member 118 comprises a generally disc-shaped valve plate 120 having a central recess 122 in its lower surface. The lower portion of the stop member 118 comprises a generally cylindrical projection 124 and a radially-extending flange 126 having a downwardly-depending rim. The cylindrical projection 124 extends through the central opening 116 in the diaphragm 110 and forms an interference fit in the recess 122 of the valve plate 120. In this way, the central opening 116 of the diaphragm 110 is closed by the stop member 118.

[0039] The internal volume 108 of the boost assembly 100 is thus divided into three chambers. A first, uppermost chamber 128 is generally defined by the cover 104 and the top surface of the valve plate 120; a second, intermediate chamber 130 is generally defined by the bottom surface of the valve member 120 and the upper surface of the diaphragm 110; and a third, lowermost chamber 132 is generally defined by the casing 106 and the lower surface of the diaphragm 110.

[0040] The casing 106 comprises a port 134 which corresponds to a port in the pump housing (not shown). A tubular sleeve 136 extends from the third chamber 132 through the port 134 in the casing 106 to be received in the port in the pump housing when the boost assembly 100 is mounted on a pump.

[0041] A control member or pin 138 is slidably received within the sleeve 136. An upper end of the control pin 138 is attached to the lower portion of the stop member 118. In use, the pin 138 extends into the pump housing through the port 134 in the casing 106, as is conventional, to cooperate with means for moving a scroll plate carriage of the pump such as a cam follower.

[0042] A bell-shaped valve seat 140 is housed within the first chamber 128. The top of the valve seat 140 is formed into a recess 142 which carries an internal thread. An adjuster gear 144, comprising a gear head 146 and a threaded shaft 148, extends through a hole 150 in the cover 104 so that the gear head 146 is accessible from the outside of the boost assembly 100 while the shaft 148 mates with the threaded recess 142 of the valve seat 140. In this way, the valve seat 140 is held in position within the first chamber 128 by the adjuster gear 144.

[0043] The relative axial position of the valve seat 140 with respect to the cover 104 can be adjusted by turning the adjuster gear 144. As shown most clearly in Figure 3, a worm screw 152, mounted in the cover 104, is engaged with the gear head 146 of the adjuster gear 144 to allow fine adjustment of the adjuster gear 144. The worm screw 152 includes, at one end, a slot 154 or other suitable means for receiving a tool for turning the worm screw 152 and hence the adjuster gear 144. In one embodiment of the invention, the position of the valve seat 140 can be adjusted by approximately 1 mm with respect to the cover 104.

[0044] A biasing spring 156 encircles the shaft 148 of the adjuster gear 144 and acts upon the cover 104 and the uppermost surface of the valve seat 140 to ensure that there is no relative axial movement between the valve seat 140 and the cover 104 unless the adjuster gear 144 is turned. An 'o' ring 157 is positioned around the shaft 148 of the adjuster gear 144 to prevent leakage of air from the first chamber 128 through the hole 150 through which the adjuster gear 144 passes.

[0045] A further 'o' ring 158 is positioned between the valve seat 140 and the cover 104, so that there is no leakage of air, from the first chamber 128 to the second chamber 130 or vice versa, between the valve seat 140 and the cover 104. The 'o' ring 158 is arranged so as not to impede the relative movement of the valve seat 140 and the cover 104 when the adjuster gear 144 is turned.

[0046] The first chamber 128 of the boost assembly 100 is connected to an air feed from the turbocharger output by way of an inlet port 160 in the cover 104. The valve seat 140 is provided with a passage 162 so as to allow the turbocharger output air to act upon the upper surface of the valve plate 120. The third chamber 132 of the boost assembly 100 is filled with fuel at constant pressure. For example, the third chamber 132 may be connected to a fuel return line via a port (not shown) in the casing 106.

[0047] The third chamber 132 contains a biasing spring 164 which is held under compression between a spring plate 165 associated with the control pin 138 and a flange 166 provided on the sleeve 136. In this way, the stop member 118 is biased so that, when the air pressure in the first chamber 128 is low, the valve plate 120 abuts a flat seating surface 168 provided on the lowermost end of the valve seat 140 to prevent air flow from the first chamber 128 to the second chamber 130. The spring plate 165 is accommodated within the downwardly depending rim of the flange 126 of the lower portion of the stop member 118.

[0048] As the air pressure in the first chamber 128 increases, as a result of an increase in turbocharger output, the downward force acting on the valve plate 120 increases until, when the air pressure reaches a threshold value, known as the threshold opening pressure, the downward force overcomes the upward biasing force of the spring 164 and the upward force due to the fuel in the third chamber 132. At this point, the valve plate 120 unseats from the seating surface 168 so that the relatively high air pressure in the first chamber 128 can equilibrate with the air pressure in the second chamber 130.

[0049] In this state, the diaphragm 110 is also subject to the relatively high air pressure from the turbocharger output. The diaphragm 110 responds by undergoing a relatively large deformation, in which the inner edge 114 of the diaphragm 110 is displaced downwards towards the pump.

[0050] Consequently, when the air pressure in the first chamber 128 exceeds the threshold opening pressure, a large downward displacement of the pin 138 takes place. As is conventional, the displacement of the pin 138 in this way gives rise to an increase in the fuel quantity delivered by the pump.

[0051] The upper end of the sleeve 136 comprises a stop 170 to limit the downward movement of the stop member 118 and hence the pin 138. Thus, when the spring plate 165 meets the stop 170, further downward movement of the pin 138 is prevented. In this way, the spring plate 165 acts as a stop element, and the spring plate and the stop 170 together provide limiting means for movement of the control pin 138. The stop 170 may comprise a jacket 172 formed around the sleeve 136, arranged so that the relative positions of the jacket 172 and the sleeve 136 can be adjusted during manufacture of the boost assembly 100.

[0052] When the turbocharger output decreases, the air pressure in the first chamber 128 falls. When the air pressure drops below that required to overcome the biasing force of the spring 164, the valve plate 120 moves upward to abut the seating surface 168. The pin 138 therefore returns to its original position and the fuel quantity delivered by the pump decreases to a non-boost value.

[0053] The increase in fuel that results from movement of the pin 138 depends upon the stroke of the pin 138 as it moves from a first, non-boost position, in which the valve seat 120 of the stop member 118 abuts the seating surface 168 of the valve seat 140, to a second, full boost position, in which the spring plate 165 of the stop member 118 abuts the stop 170.

[0054] By virtue of the adjuster gear 144, the stroke of the pin 138 can be adjusted over a limited range to account for manufacturing tolerances, wear of components and other factors. By adjusting the relative position of the valve seat 140 and the cover 104 using the adjuster gear 144, the initial non-boost position of the pin 138, and hence the starting position for the stroke, can be increased or decreased so as to ensure that the pin 138 undergoes the correct stroke when the threshold opening pressure is exceeded. In this way, the increase in fuel quantity can be optimised relative to the onset and magnitude of turbocharger boost.

[0055] For example, if testing of the engine reveals that an insufficient change in fuel quantity occurs when the turbocharger boost rises from a low pressure to a high pressure, the boost assembly 100 can be adjusted by using the adjuster gear 144 to move the valve seat 140 upwards with respect to the cover 104 to lengthen the stroke of the pin 138.

[0056] Similarly, if the change in fuel quantity that occurs when the turbocharger boost rises from a low pressure to a high pressure is excessive, the valve seat 140 can be moved downwards with respect to the cover 104, by using the adjuster gear 144, to shorten the stroke of the pin 138.

[0057] The boost assembly 100 can therefore be adjusted in-situ when installed on a fuel pump of an internal combustion engine. In this way, adjustment of the boost assembly 100 provides a means for accommodating or mitigating the combined tolerances of the engine, the pump, and the boost assembly 100.

[0058] It will be appreciated that, in this embodiment of the invention, adjustment of the position of the valve seat 140 relative to the housing 102 also causes a change in the initial preload applied to the valve plate 120 by the spring 164, which influences the threshold opening pressure of the boost assembly 100. This can provide a further means of mitigating manufacturing tolerances in the boost assembly and the pump.

[0059] Many variations and modifications can be made to the preferred embodiment described above without departing from the scope of the invention.

[0060] For example, depending on the location of the boost assembly within an engine, it may be convenient to dispense with the worm screw and gear head arrangement and instead allow direct adjustment of the adjuster gear by providing a slot for a screwdriver or similar tool in the head of the adjuster gear.

[0061] The boost assembly of the present invention can be used with a variety of fuel pumps. For example, the boost assembly 100 of Figures 2 and 3 could be substituted for the conventional boost assembly 36 of the pump 10 shown in Figure 1.

[0062] In another type of fuel pump (not shown), the cam follower can be rotatably mounted on the end of the control pin of the boost assembly according to the invention. In this arrangement, the cam follower rotates about the axis of the control pin in response to movement of the cam to adjust the position of the scroll plates. When the control pin undergoes an axial displacement, the cam follower is correspondingly raised or lowered within the casing of the pump (i.e. in a direction parallel to the axis of the control pin). This displacement also causes an adjustment of the position of the scroll plates.

Claims

1. A boost assembly (100) for a rotary fuel pump of an internal combustion engine including a turbocharger, the boost assembly comprising:

   a housing (102),
   a control member (138) which is cooperable with an adjuster of the fuel pump so as to adjust the fuel pump output,
   a displacement element (110) cooperable with the control member (138),
   a valve plate (120) engageable with a valve seat (140) so as to define a first position of the control member (138), and
   limiting means (165, 170) arranged to define a second position of the control member (138),
   wherein the valve plate (120) is movable away from the valve seat (140) in response to air pressure from the turbocharger so as to control whether the diaphragm (110) is exposed to air flow from the turbocharger, thereby to cause the control member (138) to move from the first position to the second position,
   characterised in that the boost assembly includes an adjustment means for adjusting the axial position of the valve seat (140) relative to the housing (102), thereby to adjust the first position of the control member (138).

2. A boost assembly as claimed in claim 1, wherein the limiting means comprises a stop (170).

3. A boost assembly as claimed in claim 2, wherein the

limiting means comprises a stop element (165) associated with the valve plate (120), and wherein the stop element (165) abuts the stop (170) in use of the assembly so as to define the second position of the control member (138).

4. A boost assembly as claimed in any preceding claim, wherein the displacement element comprises a diaphragm (110) having a central portion (114) associated with the control member (138) and a peripheral portion (112) attached to the housing (102).

5. A boost assembly as claimed in any preceding claim, wherein the housing (102) defines, in part, a first chamber (128) within which the valve seat (140) is housed.

6. A boost assembly as claimed in claim 5, further comprising a second chamber (130) defined in part by the valve member (120) and in part by the displacement element (110) and wherein, in use of the assembly, the first chamber (128) receives air from an output of the turbocharger; and an increase in air pressure within the first chamber (128) causes unseating of the valve member (120) to allow air flow between the first chamber (128) and the second chamber (130), thereby causing displacement of the displacement element (110) and axial movement of the control member (138).

7. A boost assembly according to claim 6, further comprising a sealing element (158) to prevent air flow from the first chamber (128) to the second chamber (130) between the valve seat (140) and the housing (102).

8. A boost assembly according to any preceding claim, wherein the adjustment means (144) comprises a shaft (148) which is threadedly engaged with a recess (142) in the valve seat (140).

9. A boost assembly according to any preceding claim, wherein the adjustment means (144) comprises a gear head (146), and wherein the boost assembly further comprises a gear mechanism (152) for turning the adjustment means (144) by way of the gear head (146).

10. A boost assembly according to any preceding claim, wherein the valve seat (140) comprises a bell-shaped element.

11. A boost assembly according to any preceding claim, wherein the valve seat (140) comprises a seating surface (168) arranged to sealingly engage with the valve member (120).

12. A boost assembly according to any preceding claim, wherein the valve seat (140) comprises a passage (162) for communication of air from an output of the turbocharger through the valve seat (140).

13. A boost assembly according to any preceding claim, wherein the valve member (120) comprises a generally circular plate-like element.

14. A boost assembly according to any preceding claim, wherein the valve member (120) is cooperable with the control member (138).

15. A fuel pump for supplying pressurised fuel to an internal combustion engine, comprising:

a boost assembly (100) according to any preceding claim, and
an adjuster cooperable with the control member (138) of the fuel pump,

wherein displacement of the control member (138) from the first position to the second position causes an increase in fuel output of the pump.

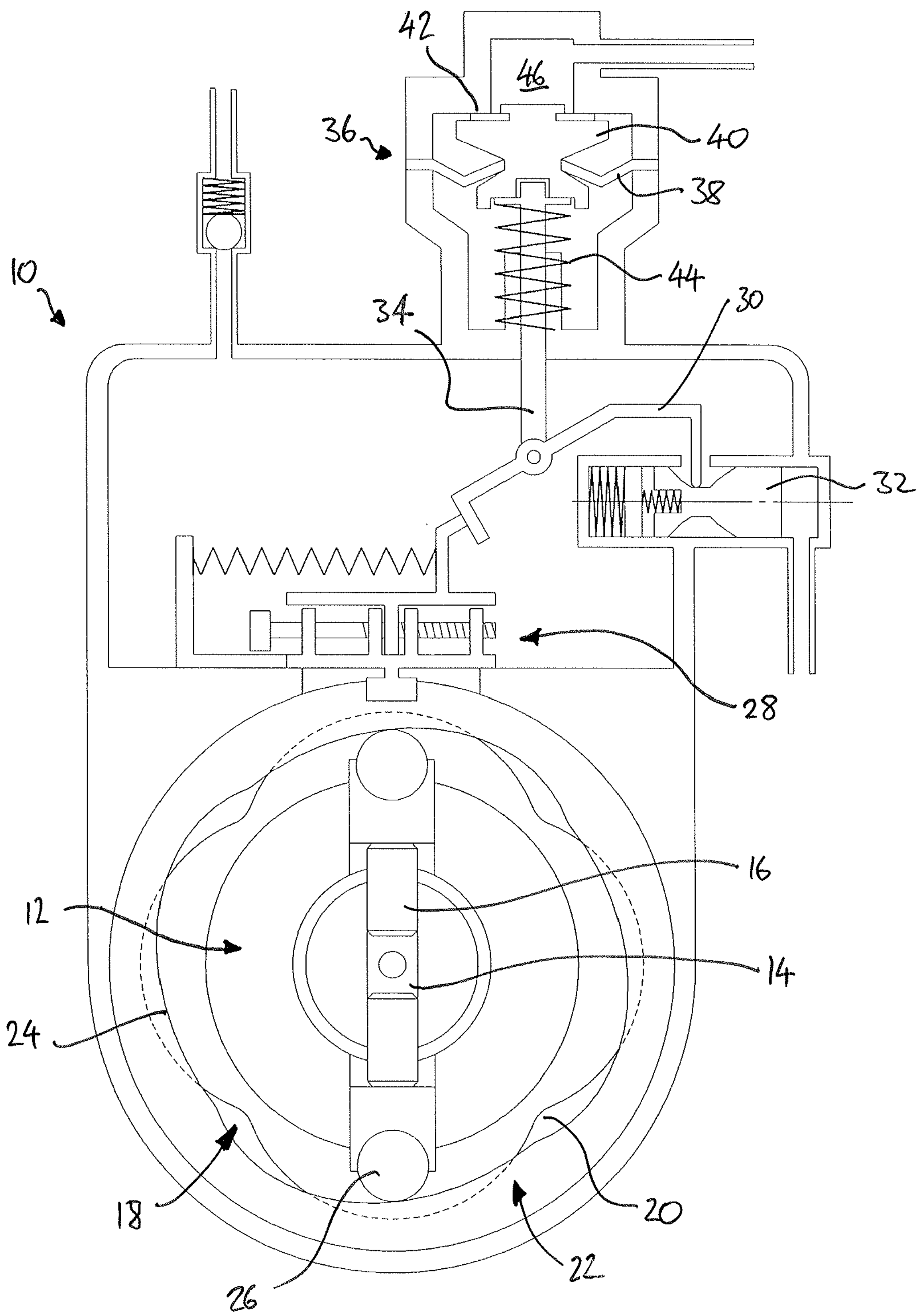

FIGURE 1

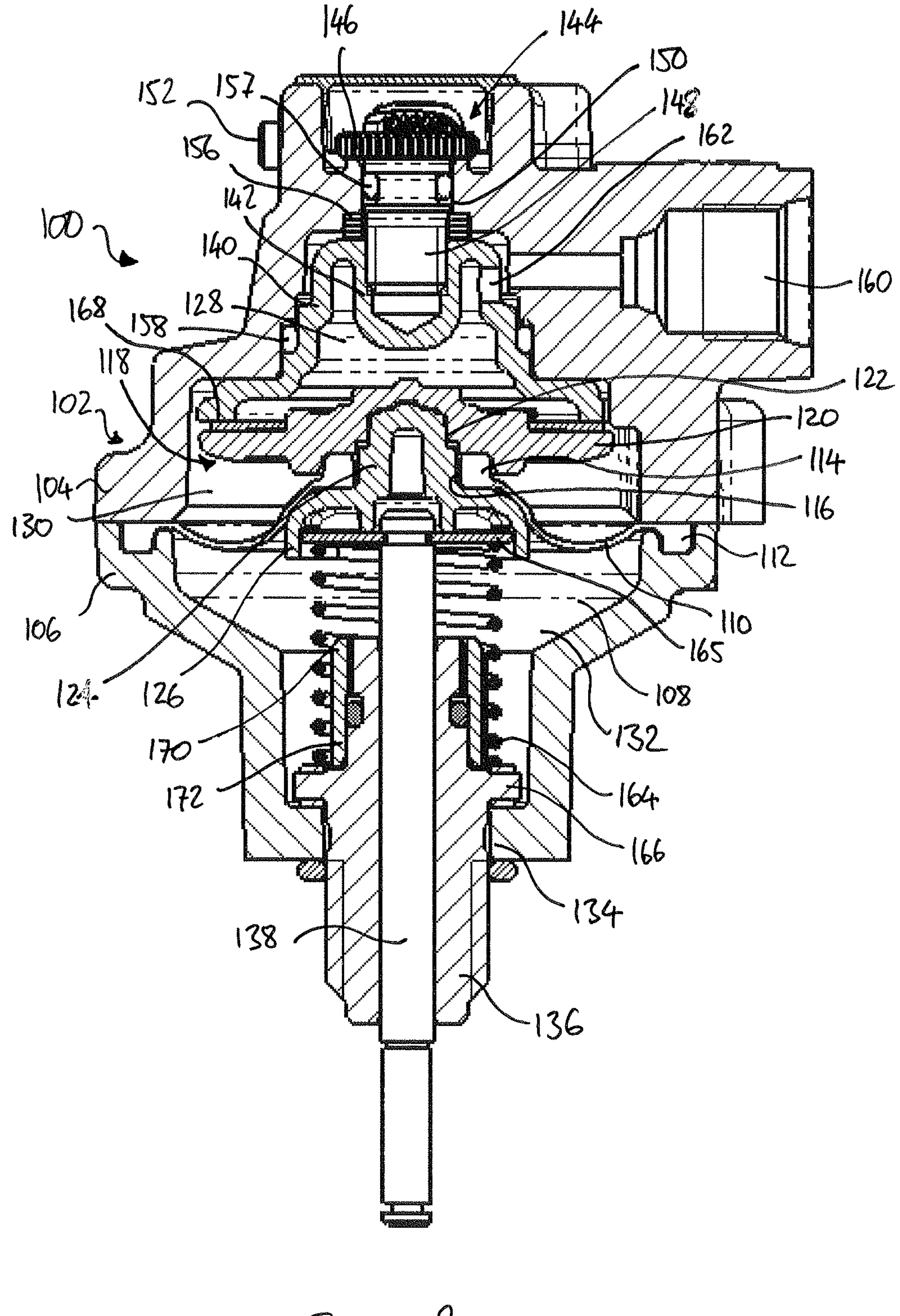
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FIGURE 2

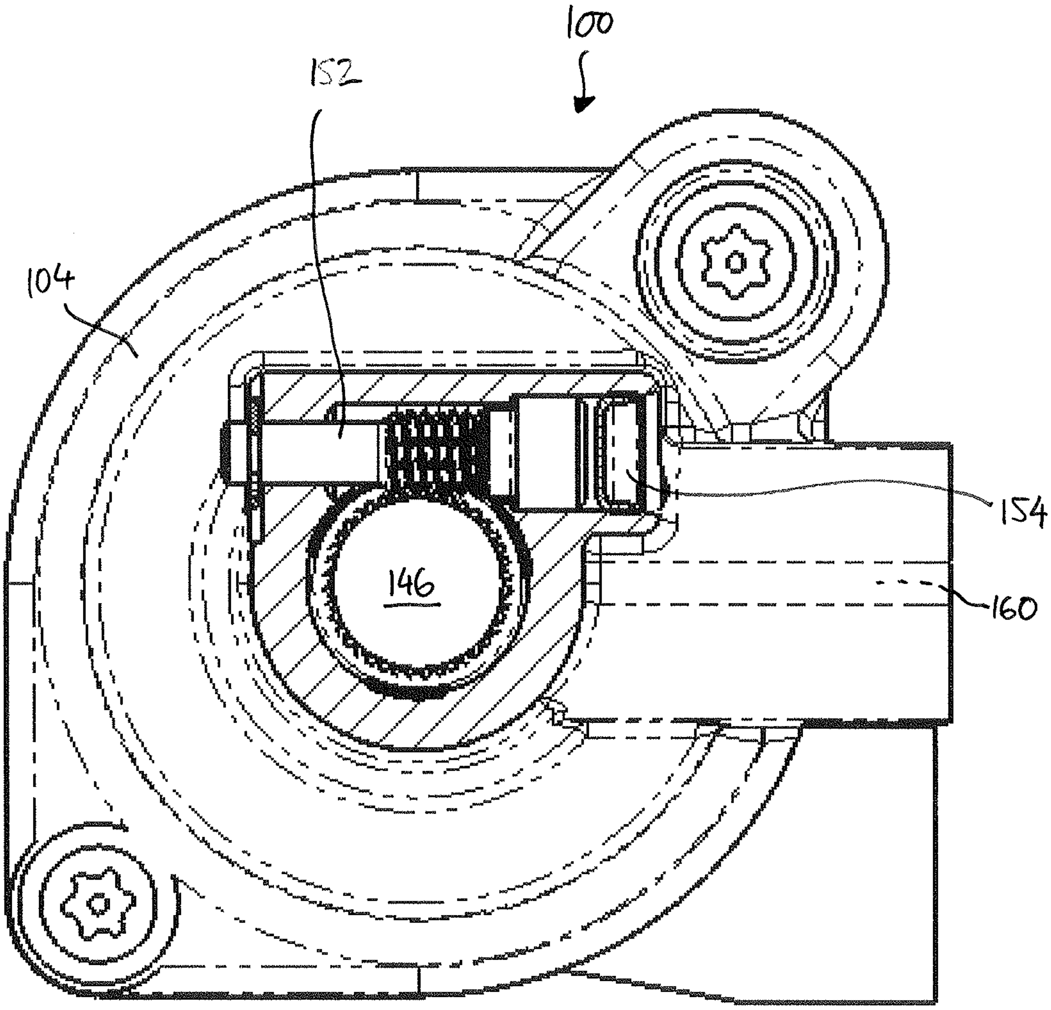

FIGURE 3

Europäisches Patentamt
European Patent Office
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EUROPEAN SEARCH REPORT

Application Number
EP 08 16 5658

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X Y	GB 2 129 968 A (BOSCH GMBH ROBERT) 23 May 1984 (1984-05-23) * figures 1-6 * -----	1,12-15 2-5	INV. F02B37/18 F02M59/44 F02D1/06
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A	JP 60 201029 A (TOYOTA MOTOR CO LTD) 11 October 1985 (1985-10-11) * figures 1,2 * -----	1	

TECHNICAL FIELDS SEARCHED (IPC)

F02B
F02M
F02D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	2 March 2009	Morales Gonzalez, M

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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